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VIRTUAL REALITY-BASED LEARNING ENVIRONMENTS FOR ENHANCING INTERPERSONAL COMMUNICATION AND DECISION-MAKING IN CRISIS MANAGEMENT TRAINING

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ABSTRACT

Objective: This research explores the potential of Virtual Reality (VR) in crisis management training, with a particular focus on improving soft skills such as communication, empathy, and decision-making.

Research Design & Methods: This research utilizes a systematic literature review of studies examining VR-based crisis management training. Key findings from empirical studies were analyzed to understand VR's role in simulating realistic crisis scenarios and its impact on technical and soft skills development.

Findings: VR-based training shows significant potential in improving soft skills, including communication, teamwork, and decision-making under pressure. Programs such as PANDORA and JUST VR show effective results when soft skills are intentionally integrated into training modules. However, accessibility and cost barriers remain significant, and many existing programs focus more on technical skills, often neglecting the soft skills component.

Implications & Recommendations: To maximize VR's potential in crisis management training, the integration of soft skills should be a priority throughout the program, with collaboration between technology developers, educators, and practitioners. Further research needs to explore innovative, affordable VR training models and measure their impact on real-world crisis performance.

Contribution & Value Added: This research expands knowledge about the role of VR in crisis management education, emphasizing opportunities and challenges in integrating soft skills. The results offer a roadmap for developing more comprehensive and accessible crisis training programs, to produce professionals capable of dealing with complex and stressful situations.

Keywords: management training, crisis management, virtual reality.

JEL codes: D83, C63, I23

Article type: research paper

INTRODUCTION

Virtual reality (VR) technology is increasingly being applied and accepted in formal education, which recognizes the need for more than just classroom experiences (Hsu et al., 2013; Shen et al., 2017). Virtual reality (VR) technology has been recognized for its potential to create realistic simulations that allow trainees to deal with crisis situations without real risk. VR offers an immersive and interactive environment that can be used for a variety of training and education purposes (Psotka, 1995). In the medical context, VR has been utilized for pre-operative planning, intra-operative guidance, and medical education, allowing practitioners to perfect their skills in a risk-free environment (Singh, 2024). Excitingly, VR applications are not limited to the medical field

alone. In the field of sports education, immersive VR systems have been designed to teach tennis in a more intuitive and visual manner (Song et al., 2012). Overall, VR offers great potential for improving training and education in a variety of fields. Its ability to create immersive and interactive experiences allows participants to develop their skills in a safe and controlled environment, while still getting a realistic and relevant experience. With the continued advancement of technology, it can be expected that VR applications will become more widespread and sophisticated in the future, opening up more opportunities for effective and innovative training and simulation. VR technology innovation for personnel education and training can offer an alternative learning approach that supports the benefits gained directly and also provides added value to meet the need for adaptive, safe, flexible and reusable modular design and training.

In crisis management, the ability to communicate effectively and make the right decisions under pressure are key elements for success. However, traditional crisis training often overemphasizes technical and procedural aspects or hard skills while the development of soft skills such as interpersonal communication and decision-making tends to be neglected. These interpersonal skills are important because crises involve dynamic interactions between individuals and teams where poor communication or incorrect decision-making can make the situation worse. As technology advances, Virtual Reality (VR) has been recognized as a tool capable of creating realistic simulations that allow trainees to practice in crisis situations without physical risk. This immersive virtual environment not only provides an experience closer to reality but can also increase participant engagement and build skills more effectively than traditional training. Early research shows VR's great potential in supporting learning in various sectors, including healthcare, security, and military education. Nonetheless, research on how VR can be used to develop interpersonal and decision-making skills in crisis contexts is still very limited.

Several previous studies have begun to highlight the effectiveness of VR in enhancing soft skills across a variety of scenarios. For example, presenting a VR-based disaster training scheme with team roles showed improved engagement and learning outcomes through collaborative problem-solving and teamwork (Xu & Dai, 2022). These results underscore how VR can facilitate interpersonal training in crisis situations, such as improving teamwork abilities and decision coordination. Other studies, such as the one conducted by (Herrmann et al. (2023), found that the use of VR significantly improved conflict communication skills and self-efficacy in clinicians, suggesting that VR could be a powerful platform for improving interpersonal skills in crisis situations. Similarly, Kim et al. (2008) found that repeated dynamic training methods in VR can improve complex decision-making, suggesting that VR is not just a technical learning tool, but can also assist in the development of strategic skills under pressure.

Furthermore, exploring the use of VR-based conversational agents to train deescalation verbal skills among healthcare workers (Moore et al., 2022). He study found that VR-based training improved verbal communication skills that are critical in crisis management. These studies suggest that, although still little explored, VR has great potential to help develop the interpersonal and decision-making skills needed in crisis situations. This research will focus on the role of Virtual Reality in soft skills learning, particularly in the context of crisis management. Through qualitative methods and document analysis, this research aims to explore how VR can help develop interpersonal communication and decision-making skills, two crucial aspects that are often missed in traditional crisis training.

LITERATURE REVIEW

Virtual Reality in Crisis Management Training

Virtual Reality (VR) is a technology that allows users to interact with a completely computer-generated environment. VR creates an immersive experience through the use of a headset that displays a three-dimensional environment. There are several types of VR, such as desktop-based VR, mobile-based VR, console-based VR, and standalone VR. VR is used in a variety of applications, including gaming, professional training, medical simulation, and education (Melinda & Widjaja, 2022). Discoveries regarding the application of cross-reality technologies in crisis management

open up new opportunities to improve the effectiveness of training and response in emergency situations. The integration of Virtual Reality (VR), Augmented Reality (AR) and Mixed Reality (MR) enables realistic and immersive simulations, facilitating a better understanding of crisis dynamics. [Yan et al. \(2022\)](#) showed that this technology can be applied to all stages of crisis management, from prevention to recovery, enabling better preparedness. VR-based training can improve empathy and communication skills, which are crucial in supporting individuals experiencing a crisis ([Dumas et al., 2022](#)).

Furthermore, research by ([Villar & León, 2023](#)) highlights the importance of guidance in stressful VR scenarios, showing how proper guidance can reduce stress and improve decision-making. These findings are particularly relevant in crisis contexts, where the ability to make the right decisions under pressure is needed. [Haber et al. \(2022\)](#) reported that although immediate cognitive outcomes may be similar, the use of VR in management training increases knowledge retention and participant satisfaction, which are important indicators for long-term success. In addition, [Liu & Becerik-Gerber \(2022\)](#) showed that personalized VR-based training according to individual performance and spatial knowledge can improve crisis response effectiveness.

Communication and Decision-Making in Crisis

VR-based immersive simulations effectively improve communication and decision-making skills in crisis situations by providing a realistic environment that mimics real-world pressures, thereby increasing participants' engagement and ability to respond to crises ([Walker et al., 2011](#)). Role simulation, as used in geoscience education, has been shown to significantly improve students' communication and decision-making skills through cross-disciplinary collaboration and real-time problem-solving ([Dohaney et al., 2015](#)). Participants reported increased confidence and competence in their abilities, especially in high-pressure situations such as press conferences ([Dohaney et al., 2015](#)). The Pandora project is an example of the integration of artificial intelligence in crisis training, creating dynamic scenarios that adapt to the performance of the trainees, thus simulating the uncertainty of a real crisis ([Bacon et al., 2011](#)). These smart environments enable stress management and decision making under pressure, increasing the realism of the training experience. While simulations are beneficial, some studies highlight challenges such as variations in readiness levels among participants, which can affect outcomes ([Dohaney et al., 2015](#)). Therefore, continuous refinement of training methods is necessary to maximize their effectiveness.

Virtual reality (VR) has shown promise in improving interpersonal and decision-making skills, especially in the context of crisis management. While traditional training methods are often less effective, VR offers an immersive experience that can simulate high-pressure scenarios, supporting the development of important soft skills. Meta analysis shows that VR training programs are generally superior to traditional methods in developing social skills, although results vary based on program design and technology used ([Howard et al., 2021](#)). VR environments can replicate the psychological stress of a real crisis, improving decision-making performance through realistic simulation and feedback mechanisms ([Snizek et al., 2001, 2002](#)). Serious games and immersive simulations are effective in crisis management training, promoting collaboration and coordination among participants ([Di Loreto et al., 2012](#)). Projects such as PANDORA focus on emotional and behaviors aspects, creating realistic scenarios that enhance strategic planning and decision making under stress ([Bacon et al., 2011](#)). Despite these advances, the integration of VR in soft skills training for crisis management is still less explored, indicating the need for further research to optimize this technology for wider applications.

METHODS

This research will use a qualitative method that combines scientific journal analysis of previous research to explore the role of Virtual Reality (VR) technology in the development of interpersonal and decision-making skills in the context of crisis management. This approach allows researchers to explore and understand more about the application of VR in existing training. The source documents to be analyzed consist of journals and scientific articles relevant to the topic of VR-based training, especially those related to the development of soft skills in crisis management.

The purpose of this analysis is to examine how VR is applied in training, including curriculum, training modules, and learning outcomes focusing on interpersonal and decision-making skills. Key indicators to be analyzed include the design of VR simulations in training and the formulated learning outcomes related to soft skills. With this approach, it is expected that this research can significantly contribute to the understanding of how VR technology can be optimized in crisis management training, as well as enrich the existing literature in the field of education.

RESULT

Document analysis reinforces the finding that Virtual Reality (VR)-based training offers an innovative and effective approach to soft skills development, particularly in the context of crisis management. By incorporating immersive technology, VR is able to simulate realistic crisis scenarios that encourage participants to hone interpersonal skills such as communication, empathy, and decision-making. Previous studies that have been analyzed show the advantages of VR in providing an immersive learning experience, allowing participants to engage in low-risk training but with a high impact on their competencies.

Table 1. Virtual Reality (VR) Based Training Research

Research Title	Key Findings
Implementing Virtual Reality Training for Librarians: Supporting Patrons in Crisis (Dumas et al., 2022)	VR improves communication and empathy skills through realistic interpersonal interaction scenarios.
Evaluating the Effectiveness of VR Training for Crisis Communication Skills Development (Dumas et al., 2023)	VR training is effective in increasing empathy, confidence, and deescalation skills in a crisis without any real risk.
Immersive Disaster Training Schema Based on Team Role-Playing (Xu & Dai, 2022)	The combination of VR and role play improves decision-making and teamwork in disaster management, increasing participant engagement.
Impact of a Remote Virtual Reality Curriculum Pilot on Clinician Conflict Communication Skills (Herrmann et al., 2023)	VR training improves conflict communication and decision-making skills in clinical conflict management, especially in summarizing and validating decisions.
Uses and Considerations for Cinematic Virtual Reality in Health Care (Love et al., 2023)	Cinematic VR improves communication, teamwork, and problem-solving skills in health training through more engaging game and cinema techniques.
Training for Crisis Decision-Making: Psychological Issues and Computer-Based Solutions (Snizek et al., 2002)	Successful crisis management training requires in-depth experience, diverse scenarios, and effective feedback. The DC-TRAIN design provides a strong framework.
Training and Learning for Crisis Management Using a Virtual Simulation/Gaming Environment (Walker et al., 2011)	Virtual environments enhance communication and decision making skills through immersive simulations of realistic scenarios.
The Development of a Rich Multimedia Training Environment for Crisis Management: PANDORA Project (Bacon et al., 2011)	PANDORA system enhances communication and decision-making training through immersive crisis simulation in a VR environment.
Interactive Scenario Immersion: Health Emergency Decision Training in JUST Project (Ponder et al., 2002)	The JUST VR system effectively simulates health emergency crisis scenarios, improving communication and decision making skills.

Research Title	Key Findings
Natural and Virtual Environments for the Training of Emergency Medicine Personnel (Ferracani et al., 2015)	Authentic role-play simulations improve communication and decision-making skills in a crisis, significantly improving student competencies.
Developing Virtual Reality Simulations for Office-Based Medical Emergencies (Lemheney, Ed.D. et al., 2016)	VR simulation improves soft skills, especially communication and decision-making in medical crisis scenarios.
Scenarios in Virtual Learning Environments for One-to-One Communication Skills Training (Lala et al., 2017)	A virtual learning environment improves interpersonal communication skills but does not focus on crisis simulation.

Source: Google Scholar, www.sciencedirect.com (2024)

Results of Data Analysis

Based on the research results summarized, Virtual Reality (VR) has proven to be a highly effective tool in developing soft skills such as communication, empathy, and decision-making in various crisis management contexts. The study Dumas et al. (2022, 2023) show that VR provides a safe and immersive environment for practicing interpersonal interactions, such as empathy and de-escalation in crisis, without any real risk. Similarly, Xu & Dai (2022) emphasized that role-playing in VR helps improve teamwork and decision-making ability under pressure, increasing participant engagement. In addition, research by Herrmann et al. (2023) strengthens that VR can improve specific communication skills, such as summarizing concerns and validating decisions in conflict, which are important for crisis management. The importance of immersive and diverse scenarios that allow participants to practice soft skills realistically (Sniezek et al., 2002; Walker et al., 2011). While the PANDORA and JUST VR systems demonstrate immersive crisis simulation is highly effective in improving communication and decision-making skills in emergency situations (Campbell et al., 2008; Ponder et al., 2002).

However, although much evidence points to the effectiveness of VR in soft skills development, there is inconsistency in the emphasis on soft skills across VR-based training programs. Some programs, such as PANDORA and JUST VR, explicitly target the development of these skills, while other programs focus more on technical or behavioral aspects, such as evacuation behavior, as identified in the study "Social Influence in Emergency Situations". Other research, such as "Developing Virtual Reality Simulations for Office-Based Medical Emergencies" and "A Review of Virtual Reality as a Medium for Safety Related Training in the Minerals Industry", show that VR is effective in simulating complex crises involving communication and decision making. However, studies such as "Scenarios in Virtual Learning Environments for One-to-One Communication Skills Training" more focused on interpersonal communication without specifically exploring VR applications in crisis. The conclusion of this analysis confirms that VR has indeed been shown to improve soft skills, but challenges remain in ensuring a consistent focus on these skills across training programs. More integrated and sustainable program design is needed to maximize the benefits of soft skills development across different crisis management training modules.

DISCUSSION

Effectiveness of VR in Soft Skills Development

This research confirms that the use of Virtual Reality (VR) in crisis training provides significant benefits in the development of soft skills, especially communication, empathy, and decision-making. By utilizing an immersive environment, VR creates an opportunity for participants to practice in realistic crisis situations without any real risk. Findings from document analysis show that VR is able to provide an immersive learning experience, which supports the development of soft skills required in crisis management. For example, VR training systems such as DC-Train use immersive multimedia to simulate crisis scenarios, which improves decision making performance

through psychological realism (Sniezek et al., 2002). In addition, the virtual environment allows participants to actively interact with the situations they face, strengthening their understanding of crisis dynamics. Thus, the integration of VR in crisis training not only helps in developing technical skills, but also prepares participants to operate better under pressure, which is crucial in emergency situations.

Challenges in Soft Skills Integration

Although the great potential of Virtual Reality (VR) is recognized, challenges in integrating soft skills aspects into VR-based training programs still need to be addressed. Many current programs focus more on developing technical skills and often overlook the importance of soft skills that are crucial in crisis situations. Programs such as PANDORA and JUST VR show that training specifically designed to develop these skills can produce effective results and benefit participants. However, Walker et al. (2011) emphasize that the architecture of the virtual environment supports interactive play, allowing personnel to practice facing real crises with tools they are familiar with. This suggests that while there are some programs that have proven effective in teaching soft skills, there is still a need to expand the focus on soft skills development across training programs. By strengthening the integration of soft skills, it is hoped that participants can be better equipped to communicate and make decisions effectively in stressful situations.

Accessibility and Cost of VR Technology

One of the main obstacles in the application of Virtual Reality (VR) in training is the accessibility of the technology. The high costs associated with procuring hardware as well as developing effective content is often a significant challenge for many training institutions, especially those with limited budgets. This creates a gap in high-quality training, where small organizations may not be able to invest in this advanced technology. Although virtual tools, such as fire evacuation simulations, have been proven effective in teaching essential procedures, many institutions still face hurdles in accessing such technology. Therefore, it becomes imperative to look for innovative ways that can make VR technology more affordable and accessible. This could involve developing cloud-based solutions, partnerships with technology providers, or financing schemes that support the adoption of VR technology in various training organizations.

The Importance of Developing Relevant Content

The development of relevant and effective Virtual Reality (VR) content is a key element in the success of VR-based training. Content that does not match the needs of participants or is less engaging can significantly reduce the effectiveness of the training, resulting in participants not being able to develop the expected skills. Therefore, it is important to establish close collaboration between technology developers, educators, and crisis practitioners. By involving all of these parties, the resulting content can be better suited to the practical needs of the field. For example, Campbell et al. (2008) showed that the RimSim tool was designed to improve team dynamics among first responders, as well as promote better situational awareness and optimal decision-making in emergency situations. Content development that focuses on real crisis scenarios and the challenges faced by responders can increase the level of engagement of participants. By practicing in an environment that mimics real-world conditions, participants not only gain hands-on experience, but also improve their ability to respond quickly and effectively. This has the potential to produce better training outcomes and prepare participants to deal with various critical situations in the future. In this context, the integration of interactive and immersive elements in VR content will greatly contribute to meaningful and practical learning.

Integrating Soft Skills to Prepare Trainees

The integration of soft skills in Virtual Reality (VR) based training plays an important role in preparing participants for complex crisis challenges. By incorporating immersive and realistic crisis simulations, VR allows participants to practice communication, empathy, and decision-making under pressure, without real risk. This simulated environment creates a safe space for participants to learn from mistakes and receive immediate feedback, which accelerates the mastery of interpersonal skills. It not only trains technical abilities, but also emotional and cognitive skills

required in crisis situations, such as maintaining calm, managing conflict, and leading a team (Dumas et al., 2022). This research suggests that VR-based training that prioritizes soft skills development will result in professionals who are more competent and prepared for emergency situations. Participants who undergo this training can respond more effectively to crisis situations, both technically and interpersonally. It is important for institutions and organizations to design VR training programs that are integrated with soft skills development, given its significant impact in shaping professionals who are adaptive, communicative, and able to make quick decisions under pressure. With this approach, training programs can produce a workforce that is more prepared and responsive to crisis situations, which in turn improves performance in emergency management in various sectors.

Further Research Needed

Further research is essential to explore ways to apply VR more widely and affordably in crisis training. There is a need for studies that focus on how VR-based training programs can be designed to emphasize soft skills development consistently. For example, research examining different VR training delivery models, such as remote training sessions or the use of mobile devices, could open up new opportunities for institutions looking to adopt this technology without requiring large investments. Furthermore, a long-term evaluation of the effectiveness of VR training in soft skills development is also needed to understand the long-term impact on performance in crisis situations.

CONCLUSION

This research confirms that Virtual Reality (VR) has significant potential in improving interpersonal communication and decision-making skills in crisis situations. VR-based learning environments provide realistic and immersive simulated experiences, allowing trainees to practice in stressful scenarios without real risk. The purpose of this study was to explore the effectiveness of VR as a training tool in the context of crisis management, focusing on the development of technical and soft skills that are crucial to the success of individuals in emergency situations. The findings show that VR is not only a tool for enhancing technical skills, but also plays an important role in the development of soft skills needed to adapt quickly and effectively in challenging situations. By utilizing VR, training institutions can develop more effective and engaging programs, integrating soft skills development into crisis management training. This research also highlights the need for consistency in focusing on soft skills development across VR-based training programs, to ensure that participants gain the necessary technical and interpersonal skills. However, challenges in technology accessibility and the cost of VR content development must be overcome for more institutions to implement these training programs. Therefore, the development of relevant and engaging content and the exploration of more flexible training delivery models are essential.

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